Optical conductivity of the nano-textured phase in 1T-TaS$_2$

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Introduction

• Pure 1T-TaS$_2$ develops commensurate charge density wave (CCDW)/Mott phase below 180 K
• Suppression of Mott phase by pressure [2] or slight Cu doping (<0.1%) [3] leads to superconductivity in the non-metallic nearly commensurate CDW (NCCDW) phase
• NCCDW phase is a mixture of nano-sized hexagonal CCDW domains and metallic triangles [1]
• Superconductivity originates in the metallic triangles in the NCCDW phase
• Normal state dc resistivity dominated by the links between the triangles? [2]
• Optical conductivity $\sigma_1(\omega)$ derived through Kramers-Kronig analysis from measured reflectivity

Motivation

• Examination of the textured NCCDW phase using optical measurements

Reflectivity

Optical conductivity $\sigma_1$ and dc comparison

Conclusions

→ Optical conductivity in the textured NCCDW phase is dominated by links between metallic regions.
→ We observe a single, wide, flat contribution, extending to 400 cm$^{-1}$, on the top of which the phonon contribution shows above 40 cm$^{-1}$

References


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